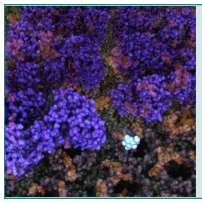

Glycolysis

hhmi | BioInteractive

Animation
Transcript

The sweet, energetic glucose molecule is the energy source providing power for your living cells. Glucose from the food you eat is slowly broken down into two pyruvate molecules, extracting energy in a sequence of enzyme reactions called glycolysis.

The glycolysis pathway requires energy to begin, delivered by chemical fuel: ATP. The primary source of ATP in your cells are mitochondria organelles.

Deep inside mitochondria, chemical reactions of aerobic respiration consume oxygen from the air you breathe to generate vast amounts of ATP. Sitting on this abundant supply of ATP is the first enzyme of the glycolysis pathway.

[Enzyme 1: Hexokinase]
The reaction of the first enzyme transfers a phosphate group from ATP to glucose, creating glucose-6-phosphate.

[Enzyme 2: Phosphoglucose isomerase]
The second enzyme rearranges glucose-6-phosphate into its isomer, fructose-6-phosphate.

[Enzyme 3: Phosphofructokinase]
The third enzyme uses a second molecule of ATP, creating fructose 1,6-bisphosphate. The six-carbon sugar is now ready to be broken apart.

[Enzyme 4: Fructose-bisphosphate aldolase]
The fourth enzyme cuts the molecule in half, creating two three-carbon sugars, each with a single phosphate attached. The sugar products are isomers of each other, but only glyceraldehyde-3-phosphate is ready to continue with glycolysis.

[Enzyme 5: Triosephosphate isomerase]
The sugar isomer, dihydroxyacetone phosphate, must first be converted through isomerization before continuing to the sixth enzyme.

[Enzyme 6: Glyceraldehyde 3-phosphate dehydrogenase]
The sixth enzyme adds a second phosphate to glyceraldehyde-3-phosphate, creating 1,3-bisphosphoglycerate, while two electrons are transferred to NAD^+, which is reduced to NADH.

Halfway through glycolysis, the cell has consumed two ATP molecules breaking down glucose and is now ready to capture energy in return.

[Enzyme 7: Phosphoglycerate kinase]
The seventh enzyme transfers a phosphate group from 1,3-bisphosphoglycerate to ADP, creating chemical fuel: ATP.

[Enzyme 8: Phosphoglycerate mutase]
The eighth enzyme rearranges the phosphate from the end of the molecule to the middle.

[Enzyme 9: Enolase]
The ninth enzyme catalyzes dehydration, increasing the potential energy in preparation for the final glycolysis reaction.

[Enzyme 10: Pyruvate kinase]
The 10th enzyme transfers the remaining phosphate group to ADP, producing ATP and the three-carbon sugar pyruvate. Glycolysis finally produces a net gain in ATP.

The glycolysis pathway breaks down glucose into two molecules of pyruvate, gaining two ATP and two NADH in the process.